REMARKS

I. INTRODUCTION

The Final Office Action mailed on July 23, 2007 and the Advisory Action mailed on October 18, 2007, and the references cited therein have been carefully studied and, in view of the following remarks, reconsideration and allowance of this application are most respectfully requested.

Claims 18-39 are currently pending. The Examiner has rejected claims 18-37 under 35 U.S.C. §103 and for double patenting. Claims 38 and 39 are new. Applicants respectfully submit that the pending claims are in condition for allowance.

II. REJECTIONS UNDER 35 U.S.C. § 103

The primary reference asserted by the Examiner in the rejection of the pending claims under 35 U.S.C. § 103 is Forrest *et al.* In the advisory action dated October 18, 2007, the Examiner states:

> Applicant argues that the ITO/metal stack of Forrest et al. is much thicker and functions differently that the instant hole recombination zone. This is not persuasive because the cited structure of Forrest that corresponds to the instant recombination zones not the stack, but the metal layer that is disclosed as being 100 Angstroms or less in thickness.

A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). In maintaining the rejection, the Examiner ignores the plain

language of the reference. Forrest et al. states that semitransparent metal layer is "placed below or adjacent to [ITO] layers 8D10, 8D11, and 8D12 to form metallic/non metallic composite charge transfer layers." (Forrest *et al.*, Page 36, lines 5-8). Forrest *et al.* states that a charge transfer layer "only delivers charge carriers from one subsection of an optoelectronic device to the adjacent subsection," which is in contrast to the recombination of charge carriers of opposite sign. (Forrest *et al.*, Page 7, lines 8-11). Forrest et al. discloses the semitransparent metal layer only as a portion of a composite charge transfer layer, the stated function of which is to transfer charge to an adjacent subsection of the device. If the semitransparent metal layer were to function in the manner suggested by the Examiner, it would no longer have its stated purpose and function. Thus, Forrest et al. teach away from the presently claimed recombination zone.

In the optoelectronic devices of the present invention, the individual subcells (which are each comprised of an electron donor layer and an electron acceptor layer) are separated by an electron-hole recombination zone. The electron-hole recombination zone serves to prevent the formation of a reverse heterojunction and/or prevents charge buildup between adjacent layers or subcells by facilitating the recombination of opposite charge carriers (i.e., electrons and holes). The effective electron-hole recombination that occurs at the electron-hole recombination zone prevents charge build-up at the interface between adjacent layers or subcells. If the opposite charges recombine, then they are not being transferred through the layer to an adjacent layer or subcell. Thus, the electron-hole recombination zone(s) is distinct from charge transfer layers, which allow charge carriers to pass from one subsection of a device to another, without recombination with a charge carrier of the opposite sign.

The function of an electron-hole recombination zone, in contrast to the function of a charge transfer layer, is consistent with the thinness of the layer as recited in claim 18. The charge-transfer layers of Forrest *et al.* are thick (over 1000 Å) to facilitate charge transfer, minimizing recombination. In contrast, the electron hole recombination zones of the present invention are thin (less than about 20 Å in claim 18) to facilitate the recombination of the opposite charges.

Forrest *et al.* states that a charge transfer layer "only delivers charge carriers from one subsection of an optoelectronic device to the adjacent subsection," in contrast to recombination of charge carriers of opposite sign. (Forrest *et al.*, Page 7, lines 8-11). Moreover, the charge transfer layer to which the Examiner refers are a composite of semitransparent metallic layers that are "placed below or adjacent to [ITO] layers 8D10, 8D11, and 8D12 to form metallic/non metallic composite" layers having a combined thickness of over 1000 Å. (Forrest *et al.*, Page 36, lines 5-8). The ITO portion of the charge transfer layer is specified as having a thickness of about 1000-4000 Å, combined with the 100 Å metallic layer to form the "metallic/non-metallic composite charge transfer layers." (Forrest *et al.*, Page 35, line 29 to Page 36 line 8). The instant electron-hole recombination zone of claim 18 has a thickness that is less than 20 Å. Due to the high thickness of the charge transfer layers disclosed in Forrest *et al.*, they can function merely to transfer the electrons or holes to the adjacent section, rather than providing a zone for recombination of the charges. Applicants respectfully submit that Forrest *et al.* do not teach or suggest an electron-hole recombination zone having a thickness of less than about 20 Å.

The Examiner has rejected claims 18-37 under 35 U.S.C. §103(a) as being unpatentable over Forrest *et al.* (WO 00/11725) in view of certain additional references. The references cited by the Examiner in combination with Forrest *et al.* are Sato *et al.* (U.S.

Patent 4,479,028) and Hanak *et al.* (U.S. Patent 4,316,049) (claims 18, 19, 22-25, and 29); Sato *et al.*, Hanak *et al.* and Peumans *et al.* (Applied Physics Letters, vol. 76(19), pp. 2650-2652, May 8, 2000) (claims 20 and 21); Sato *et al.*, Hanak *et al.* and Pettersson *et al.* (Journal of Applied Physics, vol. 86(1), pp. 487-496, July 1, 1999) (claims 27 and 28); Sato *et al.*, Hanak *et al.* and Lewis (U.S. Patent 4,771,321) (claims 18, 19, 22-26, 29, 30, 33 and 37); Sato *et al.*, Hanak *et al.*, Lewis, and Peumans *et al.* (claims 20, 21, 31 and 32); Sato *et al.*, Hanak *et al.*, Lewis, and Pettersson *et al.* (claims 27, 28, 35, and 36); and Sato *et al.*, Hanak *et al.*, Lewis, and Aratani *et al.* (U.S. Patent 5,854,139)(claim 34).

Sato *et al.* does not cure the deficiencies of Forrest *et al.* Sato *et al.* does not teach or suggest organic photosensitive optoelectronic devices comprising multiple stacked subcells in series, wherein each adjacent subcell is separated by an electron-hole recombination zone. Sato *et al.* is directed to inorganic amorphous silicon-based devices rather than the organic devices of the present invention. Further, Sato *et al.* does not teach or suggest the use of the instant electron-hole recombination zone.

Hanak *et al.* also does not cure the deficiencies of Forrest *et al.* Hanak *et al.* does not teach or suggest organic photosensitive optoelectronic devices comprising multiple stacked subcells in series, wherein each adjacent subcell is separated by an electron-hole recombination zone. Hanak *et al.* is directed to inorganic amorphous silicon-based devices rather than the organic devices of the present invention. Further, Hanak *et al.* does not teach or suggest the use of the instant electron-hole recombination zone in an organic photosensitive optoelectronic device comprising multiple stacked subcells.

Peumans *et al.* also does not cure the deficiencies of Forrest *et al.* as it does not teach or suggest the use of the instant electron-hole recombination zone.

Pettersson *et al.* also does not cure the deficiencies of Forrest *et al.* Pettersson *et al.* does not teach or suggest organic photosensitive optoelectronic devices comprising multiple stacked subcells in series, wherein each adjacent subcell is separated by an electron-hole recombination zone. Rather, Pettersson *et al.* is directed to a single cell and not a stacked subcell device.

Aratani *et al.* also does not cure the deficiencies of Forrest *et al.* Aratani *et al.* does not teach or suggest organic photosensitive optoelectronic devices comprising multiple stacked subcells in series, wherein each adjacent subcell is separated by an electron-hole recombination zone. Aratani *et al.* is directed to a field-effect transistor for use in a liquid crystal display, rather than an organic photosensitive optoelectronic device. Further, Aratani *et al.* does not teach or suggest the use of an electron-hole recombination zone in an organic photosensitive optoelectronic device.

Lewis also does not cure the deficiencies of Forrest *et al.* Lewis does not teach or suggest organic photosensitive optoelectronic devices comprising multiple stacked subcells in series, wherein each adjacent subcell is separated by an electron-hole recombination zone and wherein current generated in the first subcell and the current generated in the second subcell differ by less than about 10 %.

Furthermore, Applicants respectfully submit that there is no motivation to combine the cited references in the manner suggested by the Examiner in an attempt to arrive at the present claims. Applicants respectfully submit that the references cited by the Examiner lack the requisite reason to combine that is needed to satisfy a case of *prima facie* obviousness. It is impermissible within the framework of § 103 to pick and choose from a reference only so much of it as will support a conclusion of obviousness, to the exclusion of

other parts necessary to a full appreciation of what the reference fairly suggests to one skilled in the art. *Bausch & Lomb, Inc. v. Barnes-Hind Hydrocurve, Inc.*, 230 U.S.P.Q. 416, 420 (Fed. Cir. 1986). For prior art references to be combined to render obvious a subsequent invention under §103, there must be something in the prior art as a whole which suggests the desirability, and thus the obviousness, of making the combination. *Uniroyal v. Rudkin-Wiley*, 5 U.S.P.Q.2d 1434, 1438 (Fed. Cir. 1988). Hindsight is strictly forbidden. For many of the claims, up to four separate references are combined by the Examiner in an attempt to arrive at the presently claimed invention. The Examiner does not cite to any specific motivation within the references themselves that would support the combination of those references in the manner proposed by the Examiner. Moreover, many of the references are from different technical fields or are addressing the solution of an unrelated problem. For example, Sato *et al.* and Hanak *et al.* are directed to *inorganic* amorphous silicon-based devices rather than *organic* photosensitive optoelectronic devices. Thus, Applicants respectfully submit that there would be no motivation to combine the disclosures of Sato *et al.* and/or Hanak *et al.* with the disclosure of Forrest *et al.* Also, Aratani *et al.* is directed to a field-effect transistor for use in a liquid crystal display, rather than an organic photosensitive optoelectronic device. Also, as discussed in detail above, Forrest et al. teach away from the presently claimed invention.

For at least the above reasons, Applicants respectfully submit that the references cited by the Examiner, either alone or in combination, do not teach or suggest each of the limitations of the present claims. Furthermore, there is no reason to combine the cited references to arrive at the claimed invention. Thus, Applicants respectfully submit that the rejections under 35 U.S.C. §103(a) be withdrawn.

III. DOUBLE PATENTING

U.S. Patent No. 6,198,091

Applicants respectfully submit that the pending claims are patentably distinct from claims 1-26 of U.S. Patent No. 6,198,091. Each subcell of the stacked devices of claims 1-26 of U.S. Patent No. 6,198,091 requires both a cathode and an anode. The claims of Patent No. 6,198,091 also require subcells that are connected in parallel.

The Examiner notes claim 6 of Patent No. 6,198,091 as teaching "that each of the subcells is selected so that each of the subassemblies will generate substantially the same voltage when the device is exposed to ambient electromagnetic radiation." However, claim 6 states that the "subassemblies", not subcells, generate substantially the same current. Moreover, claim 6 depends from claim 5, which requires that the subcells are electrically connected in parallel. Thus, the electrical current generated by each subcell is independent from adjacent subcells and no recombination of electrons and holes occurs between the subcells. In other words, for each of the sub-assemblies of claim 6, the electrons and holes are removed at the contacts (cathode or electrode) for use in, or to drive a power-consuming load and thus are not transferred to an interface with the other sub-assembly. The Examiner points to Figure 8D in support of his position. However, Figure 8D depicts a series connected device ('091 patent, col. 23, lines 17-18) rather than the parallel device of claim 6.

To the extent that the anodes and cathodes of the '091 patent claims are electrodes, they are distinct from the claimed electron-hole recombination zone as the charges are removed at the contacts (cathode or anode) for use in driving a power-consuming load. The '091 patent states, "When used herein, the terms 'electrode' and 'contact' refer only to layers that provide a medium for delivering photogenerated power to an external circuit or providing a bias voltage to the device." (Col. 4, line 66 to col. 5, line 2). To the extent that

the anodes and cathode are charge-transfer layers, they are clearly distinct from the presently claimed electron-hole recombination zone for the reasons discussed in detail above.

The presently claimed devices are distinct from, and un-obvious in view of, the claims of Patent No. 6,198,091. The subcells of claims 1-26 of U.S. Patent No. 6,198,091 are not be separated by the instant electron-hole recombination zone of the present claims. As the pending claims are patentably distinct from claims 1-26 of U.S. Patent No. 6,198,091, Applicants respectfully submit that this rejection should be withdrawn.

U.S. Patent No. 6,198,092

Applicants respectfully submit that the pending claims are patentably distinct from claims 1-27 of U.S. Patent No. 6,198,092. Each subcell of the stacked devices of claims 1-27 of U.S. Patent No. 6,198,092 requires both a cathode and an anode. Further, all of the claims of U.S. Patent No. 6,198,092 are directed to a device in which each subcell is connected in parallel. Thus, the electrical current generated by each subcell is independent and no recombination of electrons and holes occurs between the subcells. In other words, for each of the subcells of the '092 patent claims, the electrons and holes are removed at the contacts (cathode or anode) for use in driving a power-consuming load and thus are not transferred to an interface with the other sub-assembly. The '092 patent states, "When used herein, the terms 'electrode' and 'contact' refer only to layers that provide a medium for delivering photogenerated power to an external circuit or providing a bias voltage to the device." (Col. 4, line 66 to col. 5, line 2). The Examiner points to Figure 8D in support of his position. However, Figure 8D depicts a series connected device ('092 patent, col. 23, lines 16-17) rather than a parallel device, as is required by the claims of the '092 patent.

The presently claimed devices are distinct from, and un-obvious in view of, the claims of Patent No. 6,198,092. The subcells of claims 1-27 of U.S. Patent No. 6,198,092 can not be separated by the instant electron-hole recombination zone of the present claims. As the pending claims are patentably distinct from claims 1-27 of U.S. Patent No. 6,198,092, Applicants respectfully submit that this rejection should be withdrawn.

Application Serial No. 10/822,774

The Examiner has provisionally rejected claims 18-37 on the grounds of nonstatutory obvious-type double patenting as being unpatentable over claims 1-31 of copending Application Serial No. 10/822,774 in view of Forrest *et al* (WO 00/11725). In support of his position, the Examiner states:

> [a]lthough the conflicting claims are not identical, they are not patentably distinct from each other because note in claim 30 of said copending application that the first organic layer (i.e., first subcell) and second organic layer (i.e., second subcell) can contribute the same amount of photocurrent to the device. Office Action of July 23, 2007, page 18.

Applicants respectfully submit that the pending claims are patentably distinct from claims 1-31 of copending Application Serial No. 10/822,774 for at least the following reasons.

The claims of copending Application Serial No. 10/822,774 are distinct from the pending claims as there is no element of the co-pending claims that would suggest the electron-hole recombination zone of the present claims. As discussed in detail above, Forrest *et al.* do not teach or suggest the presently claimed electron-hole recombination zone. Applicants respectfully submit that the claims of Application Serial No. 10/822,744 in view of Forrest *et al.* do not suggest the presently claimed electron-hole recombination zone.

Moreover, counter to the assertions of the Examiner, the first organic layer of claims 1-31 of Application Serial No. 10/822,774 is a single layer and is a "mixture of an organic acceptor material and an organic donor material." This is distinct from the subcells of the present claims which comprise two layers -- an electron donor layer and an electron acceptor layer. The second organic layer of claims 1-31 of Application Serial No. 10/822,744 is also a single layer and is an unmixed layer of the organic donor material or the organic acceptor material. This is also distinct from the subcells of the present claims which comprise an electron donor layer and an electron acceptor layer. Thus, the claims of Application Serial No. 10/822,744 are not directed to a stacked device comprising multiple subcells. As the pending claims are patentably distinct from claims 1-31 of Application Serial No. 10/822,744, Applicants respectfully submit that this rejection should be withdrawn.

Application Serial No. 10/910,371

The Examiner has provisionally rejected claims 18-37 on the grounds of nonstatutory obvious-type double patenting as being unpatentable over claims 1-32 of copending Application Serial No. 10/910,371 in view of Forrest *et al.* (WO 00/11725). In support of his position, the Examiner states

> [a]lthough the conflicting claims are not identical, they are not patentably distinct from each other because note in claim 7 of said copending application that the first organic layer (i.e., first subcell) and second organic layer (i.e., second subcell) can contribute the same amount of photocurrent to the device. Office Action of July 23, 2007, page 16.

Applicants respectfully submit that the pending claims are patentably distinct from claims 1-32 of copending Application Serial No. 10/910,371 for at least the following reasons.

The claims of copending Application Serial No. 10/910,371 are distinct from the pending claims as there is no element of the co-pending claims that would suggest the electron-hole recombination zone of the present claims. As discussed in detail above, Forrest *et al.* do not teach or suggest the presently claimed electron-hole recombination zone. Applicants respectfully submit that the claims of Application Serial No. 10/910,371 in view of Forrest *et al.* do not suggest the presently claimed electron-hole recombination zone.

Also, the first organic layer of claims 1-32 of Application Serial No. 10/910,371 is a single layer and is a "mixture of an organic acceptor material and an organic donor material." This is distinct from the subcells of the present claims which comprise two layers -- an electron donor layer and an electron acceptor layer. The second organic layer of claims 1-32 of Application Serial No. 10/910,371 is also a single layer and is an unmixed layer of the organic donor material or the organic acceptor material. This is also distinct from the subcells of the present claims which comprise an electron donor layer and an electron acceptor layer. Thus, the claims of Application Serial No. 10/910,371 are not directed to a stacked device comprising multiple subcells. As the pending claims are patentably distinct from claims 1-32 of Application Serial No. 10/910,371, Applicants respectfully submit that this rejection should be withdrawn.

The Examiner states that "the language 'comprising an electron donor layer and an electron acceptor layer' in the instant claims is so broad that it encompasses the situation in the claims of the '744 and '371 applications where the electron donor and electron acceptor are in the same 'layer', and the situation in the claims of the '371 application where there is a further unmixed layer acceptor or donor material." Applicants respectfully submit that the Examiner is mistaken. The instant claims clearly recite both an electron donor layer and an electron acceptor layer. It is clear by the plain language of the

instant claims that at least two layers are thus required for each subcell (an electron donor layer and an electron acceptor layer).

IV. CONCLUSION

Applicants respectfully submit that the pending claims are in condition for allowance and request that such action be taken. If for any reason the Examiner believes that prosecution of this application would be advanced by contact with the Applicants' attorney, the Examiner is invited to contact the undersigned at the telephone number below.

Respectfully submitted,
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Dated: October 31, 2007 By: _____
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